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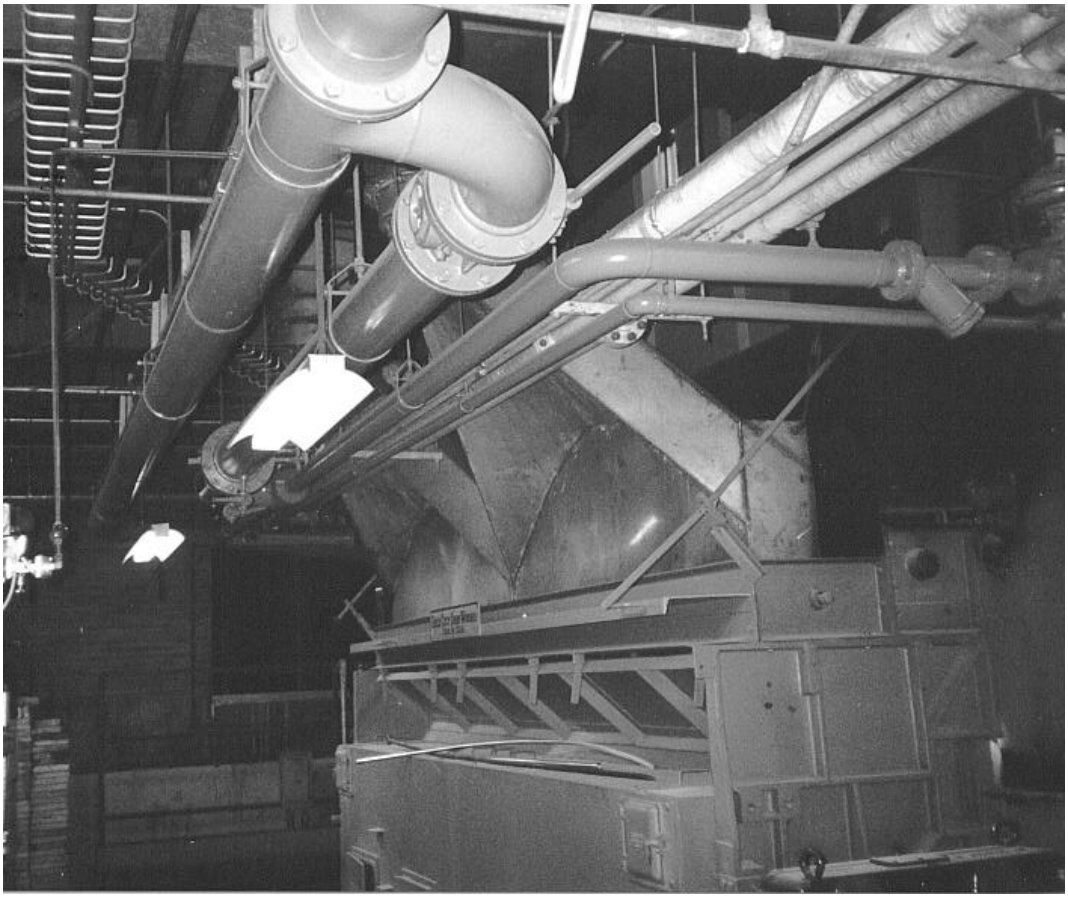
EPA Coalbed Methane Outreach Program Technical Options Series

COFIRING COAL MINE METHANE IN COAL-FIRED UTILITY AND INDUSTRIAL BOILERS



Coal Stoker Boiler Equipped for Natural Gas Cofiring
(Photo Courtesy of Energy Systems Associates)

A PRACTICAL, ECONOMICAL USE FOR COAL MINE

- Reduces emissions of SO_2, NOx, CO_2 and methane (a potent greenhouse gas)
- Reduces operating and maintenance costs, and improves stack opacity and ash quality
- Ideal for medium-quality (below pipeline spec) gas that mines recover from gob areas
- Commercially proven using conventional natural gas in the United States and elsewhere
- Commercially proven with coal mine methane

why Consider Cofiring Coal Mine Methane in Boilers?

Cofiring is the combustion of gas with coal in the primary combustion zone of a coal-fired boiler

Coal mine methane, like conventional natural gas, is an ideal boiler fuel because it requires no storage or preparation for combustion. For years, gassy coal mines in China, the Czech Republic, Poland, Russia, and Ukraine have taken advantage of their abundant supply of methane by cofiring it with coal in their boilers to produce heat and/or electricity. In addition to on-site use at the mine, mines can pipe methane to nearby power plants or other industries for cofiring in their boilers.

The gas input to a boiler may vary from less than 10 percent to 100 percent of total fuel input depending on boiler design, gas availability, and the needs of the boiler operator. The required equipment is commercially available, meets all applicable codes, and, in many cases, is already in place.

The benefits of coal mine methane use in coal boilers include improved combustion and boiler control, and reduced pollution

Because it contains no ash, virtually no sulfur, and is low in nitrogen, the firing of coal mine methane in coal boilers reduces SO_2, NO_X, and particulate emissions. These benefits are more important than ever before, because of new EPA particulate emissions regulations. The improved combustion achieved with cofiring can also improve carbon burnout and reduce opacity problems. Boiler operators can inject coal mine methane into different areas of the boiler to address a variety of boiler operational concerns, such as slag buildup. The ease of boiler conversion and low capital cost of cofiring can represent a low-risk approach to improving boiler performance. Coal-fired utility boilers in the U.S. consumed more than 70 billion cubic feet of conventional natural gas in 1995. These boilers used this gas for ignition, warm-up, and load carrying.

Many gassy coal mines are in close proximity to industrial boilers, and at least ten gassy coal mines in the U.S. are within 20 miles of utility boilers. EPA's Coal Mine Methane Outreach Program has prepared a report (available on request) identifying several potential sites in the U.S. that could economically cofire coal mine methane.

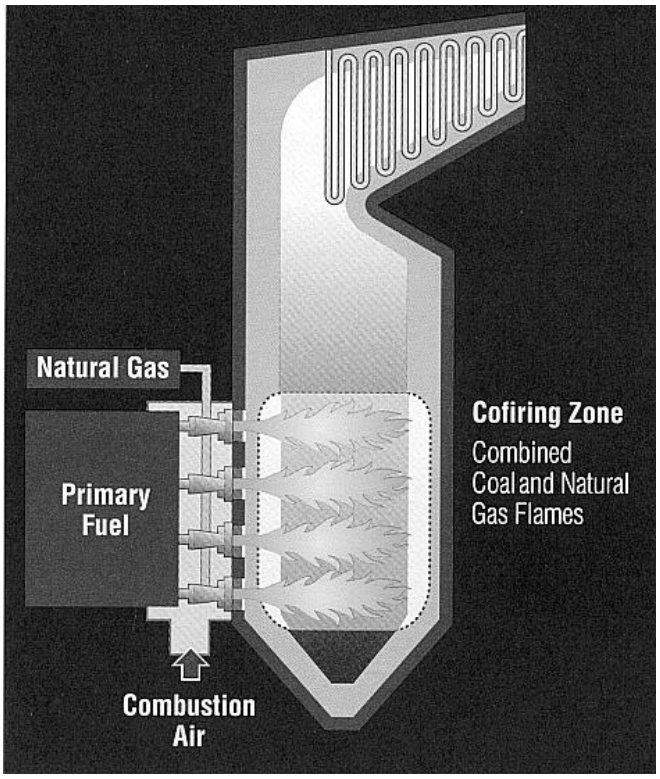
Cofiring Gas in Coal Boilers Can Result in...

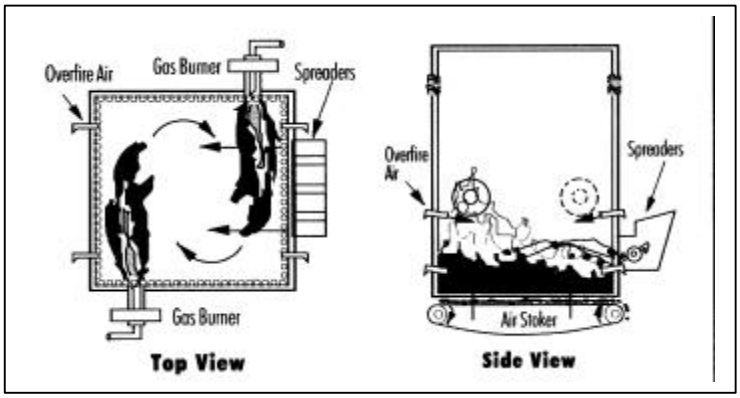
- **Net Cost Savings -** Low capital investment and rapid return on investment
- **Better Efficiency -** Improved carbon burnout, lower excess air level
- **Reduced Emissions** of NO_x, SO_x. particulates, CO_2 and CH_4 (greenhouse gases)
- **Improved Operation -** Easier startup, increased short-term peaking capacity
- **Lower Startup Costs** compared to oil
- **Improved Ash Quality,** making the ash a saleable commodity in many cases

Numerous gassy coal mines in several countries successfully cofire methane in their boilers to produce heat and/or electricity

Economics of Cofiring Coal Mine Methane at a Coal Fired Power Plant

EPA analyzed the economics of cofiring coal mine methane in several coal-fired power plants. A project in which 4 mmcf of methane per day replaces 3% of the coal used in a 600 MW boiler located 17 miles from a mine would yield a net present value (NPV) of more than $5 million and an internal rate of return (IRR) of 29%. These results are based on conservative cost estimates for gathering, transportation, compression and boiler conversion. The model also recognizes the economic benefits of NO_X and SO_X reduction achieved by cofiring methane. If the same mine produces 6 mmcf of methane per day for use in the boiler, the NPV is more than $10 million and the IRR is 44%. Economic benefits increase as the volume of methane recoverable increases.





Various types of boilers can cofire coal mine methane, just as they would conventional natural gas. *Left*, cofiring in a wall-fired utility boiler. *Above*, cofiring in an industrial stoker boiler.

(Illustrations from the Gas Research Institute brochures "Cofiring Case Studies: Competing in a

The Gas Research Institute (GRI) has evaluated the use of cofiring at numerous utility and industrial boilers. More than 370 utility boilers in the U.S. now have cofiring capability, and GRI and others have documented the many benefits. The table below shows how the emission, operation, and performance benefits of cofiring in three diverse cases - a municipal power plant, an institution, and a manufacturing company- more than justify the cost.

Three Industrial Boiler Case Studies: Quantifiable Benefits

Industry/Institution	Dover Light and Power	Oberlin College	The Hoover Company
Boiler Type (all stoker)	17 MW_e, 165,000 lb/hr spreader	40,000 lb/hr chain grate	75,000 lb/hr chain grate
% of Gas Cofired	8-15%	20%	40%
Benefits (Emissions Reduction, Improved Operation, Efficiency)	$0.29 / MmBtu	$1.67 / MmBtu	$1.20 / MmBtu
Costs (Fuel Price Increase, Annualized Capital Cost)	$0.15 / MmBtu	$0.52 / MmBtu	$0.78 / MmBtu
Net Cost Savings	$0.14 / MmBtu	$1.15 / MmBtu	$0.42 / MmBtu
Payback (simple)	1.4 years	1.8 years	3.1 years
Benefits Realized	• Efficiency up 3-4% • Particulates down 33% • Recovered lost capacity • Clean, fast light-off	• Eliminated use of separate boiler for low steam demand periods • Improved efficiency	• Emissions reductions • Load following capability • Improved opacity • Gas-only startup
Cost data are approximations based on interpretation of graphs from GRI brochure "industrial Boiler Gas Cofiring".			

For More Information...

Utility plant operators, manufacturers, and institutions are seeking ways to cut costs, improve performance, and comply with air quality regulations. Utilities and other industries recognize the benefits of cofiring gas in coal-fired boilers, and the use of coal mine methane for this purpose may be a profitable alternative to conventional natural gas.

To obtain more information about natural gas cofiring in utility boilers, contact:

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Or contact EPA's Coalbed Methane Outreach Program for information about this and other profitable uses for coal mine methane:

http://www.gri.org

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COALBED METHANE OUTREACH PROGRAM